

WHAT IS CLAIMED IS:

1. A method for adaptively controlling network traffic load in a communications network with a shared communications medium

5 comprising:

determining the network traffic load;

calculating network performance metrics based on the network traffic load; and

adjusting the network traffic load based on the network performance metrics.

2. The method of claim 1, wherein the shared communications medium is shared by a plurality of stations, and wherein only stations with traffic to transmit monitor traffic load and calculate network performance metrics and adjust traffic load.

3. The method of claim 1, wherein the network performance metrics are selected from the group consisting of: an amount of time the shared communications medium is in an idle state, an amount of time the shared communications medium is in a collision state, an amount of time the shared communications medium is in a successful transmission state, a

number of frames successfully transmitted, a number of frames unsuccessfully transmitted, and combinations thereof.

4. The method of claim 1, wherein determining the network traffic load  
5 comprises monitoring a status of the shared communications medium for every time slot of the shared communications medium.

5. The method of claim 4, wherein determining the network traffic load is performed by a hybrid controller.

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6. The method of claim 4, wherein the shared communications medium is shared by a plurality of stations, and wherein determining the network traffic load is performed by each station.

15 7. The method of claim 1, wherein the adjusting step comprises:  
calculating adjustments to network access parameters based on the network performance metrics; and  
determining the network access parameters.

8. The method of claim 7, wherein the shared communications medium is shared by a plurality of stations, and wherein the network access parameters are determined by each station.

5 9. The method of claim 7, wherein the network access parameters are selected from the group consisting of: contention window size, traffic category permission probability, DIFS value, PIFS value, SIFS value, EIFS value, update interval size, update interval threshold, backoff time amount, and combinations thereof.

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10. The method of claim 7, wherein the network access parameters are determined by a hybrid controller.

11. The method of claim 11, wherein the shared communications  
15 medium is shared by a plurality of stations, and wherein the network access parameters are transmitted to each station in a beacon frame.

- (1) determining traffic category permission probabilities;
- 5 (2) calculating an overall permission probability,  $PP$ ;
- (3) contending for access to the shared communications medium;
- (4) determining updated traffic category permission probabilities; and
- (5) repeating steps (2)-(4) until buffered traffic is transmitted.

10 13. The method of claim 12, wherein determining traffic category  
permission probabilities comprises a centralized controller assigning the  
traffic category permission probabilities.

14. The method of claim 12, wherein the shared communications  
15 medium is shared by a plurality of stations, and wherein determining traffic  
category permission probabilities comprises each station assigning the  
traffic category permission probabilities.

15. The method of claim 12, wherein there are a plurality of traffic  
20 categories, and wherein a traffic category permission probability is assigned  
for each traffic category.

16. The method of claim 15, wherein the calculating an overall permission probability,  $PP$ , is a summation of the traffic category permission probabilities assigned to each traffic category.

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17. The method of claim 12, wherein the shared communications medium is shared by a plurality of stations, and wherein the calculating overall permission probability step is performed by stations with traffic to transmit.

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18. The method of claim 12, wherein the contending for access step comprises:

determining if a contending station is permitted to transmit; and  
sending traffic from an appropriate traffic category.

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19. The method of claim 18, wherein the determining step comprises:

generating a random number,  $X$ ; and

granting the contending station permission to transmit only if the random number,  $X$ , is less than or equal to the overall permission

20 probability,  $PP$ .

20. The method of claim 18, wherein the sending traffic from an appropriate traffic category comprising sending traffic from traffic category  $N$ , where  $N$  meets the following criteria:

if  $0 < X \leq TCPP_1$ , then  $N = 0$ ; else

5 if  $\sum_{i=0}^{M-1} TCPP_i < X \leq \sum_{i=0}^M TCPP_i$ , then  $N = M$ .

where  $TCPP_i$  is the traffic category permission probability for traffic category  $i$  and is set to zero if traffic category  $i$  has no traffic to send from the contending station.

10 21. The method of claim 12, wherein the contending for access step comprises:

setting a backoff timer;

determining if a contending station can transmit; and

sending traffic from an appropriate traffic category.

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22. The method of claim 21, wherein the setting a backoff timer comprises:

generating a random number,  $X$ ;

calculating a backoff time based on the random number,  $X$ ; and

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setting the backoff timer to the backoff time.

24. The method of claim 21, wherein the determining step comprises:

- freezing a backoff timer when the shared communications medium is busy;
- decrementing a backoff timer after the shared communications medium is idle for a point coordinating function inter-frame space period;
- and
- waiting until the backoff timer expires.

if  $0 < C * X \leq TCPP_1$ , then  $N = 0$ ; else

$$\text{if } \sum_{l=0}^{M-1} TCPP_l < C^* X \leq \sum_{l=0}^M TCPP_l, \text{ then } N = M.$$

where  $C = \sum_{i=0}^Z TCPP_i$ ,  $Z$  is a total number of traffic categories, and  $TCPP_i$  is

the traffic category transmission probability for traffic category  $i$  and is set to zero if traffic category  $i$  has no traffic to send from the contending station.

26. The method of claim 12, wherein the determining updated traffic category permission probabilities step updates the traffic category permission probabilities by an amount that is proportional to how far a ratio of an amount of time the medium is in an idle state to an amount of time the medium is in a collision state is from optimal.

27. The method of claim 12, wherein the determining updated traffic category permission probabilities occurs at regular fixed intervals of time.

28. The method of claim 12, wherein the shared communications medium is shared by a plurality of stations, and wherein the determining traffic category updated traffic category permission probabilities is performed at each station with traffic to transmit.

29. The method of claim 12, wherein the determining updated traffic category permission probabilities is performed at a centralized controller.

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30. The method of claim 12, wherein the determining updated traffic category permission probabilities step occurs at irregular time intervals and is triggered by a network performance metric.

- 5 31. The method of claim 30, wherein the network performance metric is a ratio of an amount of time the medium is in an idle state to an amount of time the medium is in a collision state is outside of an interval  $(1 - \epsilon, 1 + \epsilon)$ , where  $\epsilon$  is a predetermined value.

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36. The transmitter of claim 35, wherein the transmission of the traffic category permission probabilities occurs following an update of the traffic category permission probabilities.

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37. A station comprising:

a memory;

a processor coupled to the memory, the processor containing  
circuitry to generate and update traffic category permission probabilities;

5 a medium contention unit, coupled to a shared communications  
medium and the processor, the medium contention unit contending for  
access to the shared communications medium, the medium contention unit  
comprising:

a medium status flag, coupled to the shared communications  
10 medium, the medium status flag to denote the status of the shared  
communications medium;

a station status flag, coupled to the shared communications  
medium and the processor, the station status flag to denote the state of the  
station for transmission; and

15 the station further comprising a transmitter, coupled to the processor  
and the shared communications medium, the transmitter to transmit  
information.

38. The communications station of claim 37, wherein the station status  
20 flag is asserted when a timer has counted a prespecified number of idle  
slots.

39. The communications station of claim 37, wherein the station status flag is asserted when a random number generated by the processor is less than or equal to an overall permission probability calculated by the processor.
40. The communications station of claim 37, wherein the medium status flag is asserted when the shared communications medium is sensed by the communications medium to be in an idle state.
41. The communications station of claim 37, wherein the station is permitted to transmit information when both the medium status flag and the station status flag are asserted.
42. The station of claim 37, further comprising:  
a network monitor, coupled to the shared communications medium and the processor, the network monitor to calculate network performance metrics; and  
a update probability signal flag, coupled to the processor, the update probability signal flag to denote that the traffic category permission probabilities require updating.

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47. The communications station of claim 46, wherein the station receives the traffic category permission probabilities from a centralized controller.

48. The communications station of claim 46, wherein the traffic category permission probability update flag is asserted when the station receives an update of the traffic category permission probabilities.

- 5 49. The communications station of claim 48, wherein the processor calculates a new overall permission probability when the traffic category permission probability update flag is asserted.

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50. A communications network comprising:
- a shared communications medium;
  - at least two stations, coupled to the shared communications medium, each station capable of communicating with the other, each station comprising:
    - a memory;
    - a processor coupled to the memory, the processor containing circuitry to generate and update traffic category permission probabilities;
    - a medium contention unit, coupled to the shared communications medium and the processor, the medium contention unit contending for access to the shared communications medium, the medium contention unit comprising:
      - a medium status flag, coupled to the shared communications medium, the medium status flag to denote the status of the shared communications medium;
      - a station status flag, coupled to the shared communications medium and the processor, the station status flag to denote the state of the station for transmission; and
      - the station further comprising a transmitter, coupled to the processor and the shared communications medium, the transmitter to transmit information.



